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ANTHEROPHAGUS OCHRACEUS MELS. IN THE NESTS OF BUMBLEBEES

THE recent appearance of two articles on "The Phoresy of *Antherophagus*," one by W. M. Wheeler (1919) and the other by H. Donisthorpe (1920) have prompted me to publish some additional observations on the habits of *Antherophagus ochraceus* Mels. in this country.

Wheeler writing in December, 1919, recorded the capture of an adult of this beetle near Colebrook, Connecticut, attached to the proboscis of a worker bumblebee (*B. vagans*). When the bumblebee, which vainly tried to rid herself of the beetle, was placed in a cyanide jar, the beetle still maintained its hold. In this same article there is a discussion of the phenomenon of "phoresy" as defined by Lesne (1896) and expanded by Janet (1897), together with an account of the known habits of *Antherophagus* and a bibliography. Donisthorpe in October, 1920, published a résumé of Wheeler's paper, presenting further information concerning "phoresy" in general, the habits of *Antherophagus*, and additional references. Scott (1920) has also contributed to our knowledge of the biology of these beetles.

Many of the rather numerous European references report the finding of *Antherophagus* (*pallens*, *silaceus* and *nigricornis*) and of *Cryptophagus* (*setulosus*, and *sp.*) in the nests of various species of bumblebees. The only American record actually citing an instance of finding *Antherophagus ochraceus* Mels. in the nests of bumblebees is that given by A. S. Packard (1864) based on observations made by F. W. Putnam in Massachusetts and Vermont. J. B. Smith (1909), without giving any data, says that *Antherophagus* occurs in the nests of bumblebees. This latter note is probably based on the statements by Packard, or else on accounts of the habits of the European members of this genus.

While in Wisconsin last summer (1920), I was able to examine many bumblebees nests in various parts of that state, through the kindness of Dr. S. B. Fracker. On two different occasions I found *Antherophagus ochraceus* (C. A. Frost det.) in the nests. In one nest of *Bremus* (*Bombus*) *fervidus* (Fabr.) examined August 12, 1920, were eighteen adult specimens of this beetle.

At the same time and place I took thirty-four larvæ of a small beetle in various stages of development. As these larvæ were associated with the beetles and as they agree with the figure and brief description of *A. ochraceus* given by Packard (1883), I assume them to be the same. In another nest of *Bremus* (*Bombias*) *auricomus* (Robt.) opened on July 26, 1920, at Clyman Junction, Wisconsin, I found a single adult of *A. ochraceus*. Again on October 3, 1920, near White Heath, Illinois, I collected about a dozen small beetle larvæ in a surface nest of *B. Pennsylvanicus* (DeGeer). These last-mentioned larvæ differ slightly from those found in the nest at Baraboo, Wisconsin, and if not the same species may represent another species of *Antherophagus*.

There has been much discussion as to the feeding habits of the adult and larval *Antherophagus*. Wheeler, after a survey of the literature of the subject, came to the conclusion that the larvæ were "in all probability merely scavengers in the *Bombus* nests." Wagner (1907) expresses the idea that they "will occasion enormous destruction in the nest," but without giving an instance of the same. I believe that these insects are purely scavengers, not only feeding on the excrement of the bumblebees as suggested by some, but also on all kinds of refuse as maintained by Reuter (1913). In the nests I examined containing *Antherophagus ochraceus*, the beetles and larvæ were never on that portion of the comb then being used by the bees. They were always either on the old decaying empty cocoons on the bottom of the nest, or in the débris directly beneath or surrounding the comb. Such are not the habits of the true parasites and harmful inquilines of bumblebees. The larvæ of *Vitula* (*Nephopteryx* in litt.) *edmansii* described by Packard from the nests of bumblebees feed on the pollen, honey, wax or cells of the comb. To escape being killed by the bumblebees or carried out of the nest, the larvæ of this moth spin a regular labyrinth of silken tubes or cases and never expose themselves to the bumblebees. The larvæ of *Antherophagus* do not spin protective cases and are in no sense of the word parasitic on the adult bees, larvæ or pupæ. If they, thus unprotected, should crawl conspicuously over the comb to destroy the eggs, larvæ or pupæ, or to eat the new comb and stored food, they could easily be combated by the bumblebees. Furthermore, the nest containing the thirty-four larvæ and eighteen adult beetles taken at Baraboo, Wisconsin, showed no signs of the great destruction mentioned by Wagner. For that time of

year, August 12, it was in fact a strong colony, containing ninety-one workers, fifty-six pupal cocoons, and large stores of honey and pollen. It is possible that the upper part of the comb of a bumblebee nest might develop so swiftly in some cases, as to cause some cells either filled or not filled with pollen and honey on the lower part of the comb to be neglected, and thus infested with *Antherophagus*. This last statement, however, would certainly be the exception rather than the rule. In the cases that have come under my observation *A. ochraceus* played the rôle of a scavenger, in the débris beneath and about the nest, feeding on the refuse comb, feces, honey, or bits of pollen and wax that perchance had fallen to the bottom of the nest.

Wheeler voices the opinion of Sharp (1899) that the instincts of the beetle permit it to recognize the bumblebee, but not to enable it to find the nest. Therefore the beetle waits on flowers until it can attach itself to a bumblebee and be conveyed to the nest of the latter. Donisthorpe suggests that "it is not so much that they [*Antherophagus*] lack the instinct to find the bee's nest, but rather that it gives them protection from their hosts when they arrive there." *Antherophagus* may or may not be able to find the nests of bumblebees of its own accord, but I am inclined to doubt whether the occasion of the "phoresy" is protective, in that it gives "them protection from their hosts when they arrive there," by their having acquired the nest "aura." If *Antherophagus* is a scavenger, as the evidence seems to indicate, and keeps well hidden in the débris on the bottom or sides of the comb, why is there a need for a nest "aura"? One of these beetles carried to a bumblebee's nest, in all probability, soon after arriving there, releases its hold and falls down to the lower part or bottom of the nest. Many other beetles are accidental visitors or inhabitants of such nests, and living thus in the material about and beneath the comb are not noticed by the ever-watchful bees and go unmolested. W. H. Tuck (1896, 1897) lists over sixty species of beetles from the nests of various species of bumblebees in England, most of which are undoubtedly only casual intruders. I have taken specimens of *Harpalus* sp. and *Onthophagus hecate* Panz. in the nests of bumblebees. Such beetles are much larger than *Antherophagus*, are not even considered as "anthophilous" (Lovell, 1915), nor have they ever been accredited with habits of "phoresy." Evidently then, such beetles gain entrance to the nest and live there for a time at

least without having first acquired a nest "aura." I believe that *Antherophagus* often, if not always, forces the bee to carry it simply in order to find the nest, and not to acquire a nest "aura," such as all the bees of each and every colony possess. If *Antherophagus* had habits similar to those of the inquiline-bee *Psithyrus*, there would be an advantage in having a nest "aura."

Scott (1920) says that

Presumably these [*A. pallens*] beetles are double-brooded, with a short summer generation intervening between the emergence of the adults in May and the assumption of the resting condition by the larvæ in autumn.

I have taken adults of *A. ochraceus* by sweeping flowers on May 7 and 23, 1917. The insect collections of the Illinois State Natural History Survey contain adults taken on July 19, 23 and 30, 1891, and August 15, 1893. Blatchley (1910) mentions the species as occurring on flowers, June 24 to September 21. As previously mentioned I took one adult in a bumblebee nest on July 26 and eighteen more on August 12. The adults taken on May 7 and 23 certainly represent the hibernating brood. Those found both out of doors and also in a nest on July 19-30, are in all probability the adults of the first brood or summer generation. Those taken on August 12-15, may represent a true second summer generation, but more than likely belong to the same brood of July 19-30. Scott found that *A. pallens* hibernated as larvæ, pupating in early summer. Some of the larvæ presumably those of *Antherophagus* which I took on October 3, when examined on November 11, 1920, had constructed cells in the earth on the bottom of the rearing jar; thus indicating that they hibernated as larvæ. Summarizing these records: *A. ochraceus* is probably double-brooded, hibernating as larvæ in cells in the soil or material about or under the bumblebee nest.

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